The Observing System Monitoring Center

Steven Hankin[1], Kevin J. Kern[2] and Ray ("Ted") Habermann[3]
[1] NOAA Pacific Marine Environmental Laboratory, Seattle, WA
[2] NOAA National Data Buoy Center, Stennis Space Center, MS
[3] NOAA National Geophysical Data Center, Boulder, CO

Project Summary

The Observing System Monitoring Center (OSMC) is an information gathering, decision support, and display system for the National Oceanic and Atmospheric Administration's (NOAA) Office of Climate Observations (OCO) located in Silver Spring, MD. The OSMC permits the many "networks" of *in situ* ocean observing platforms -- ships, floats, tide gauges, etc. -- to be viewed as a single system. It is a key integrating component for the management of a sustained Ocean Observing System for Climate.

.

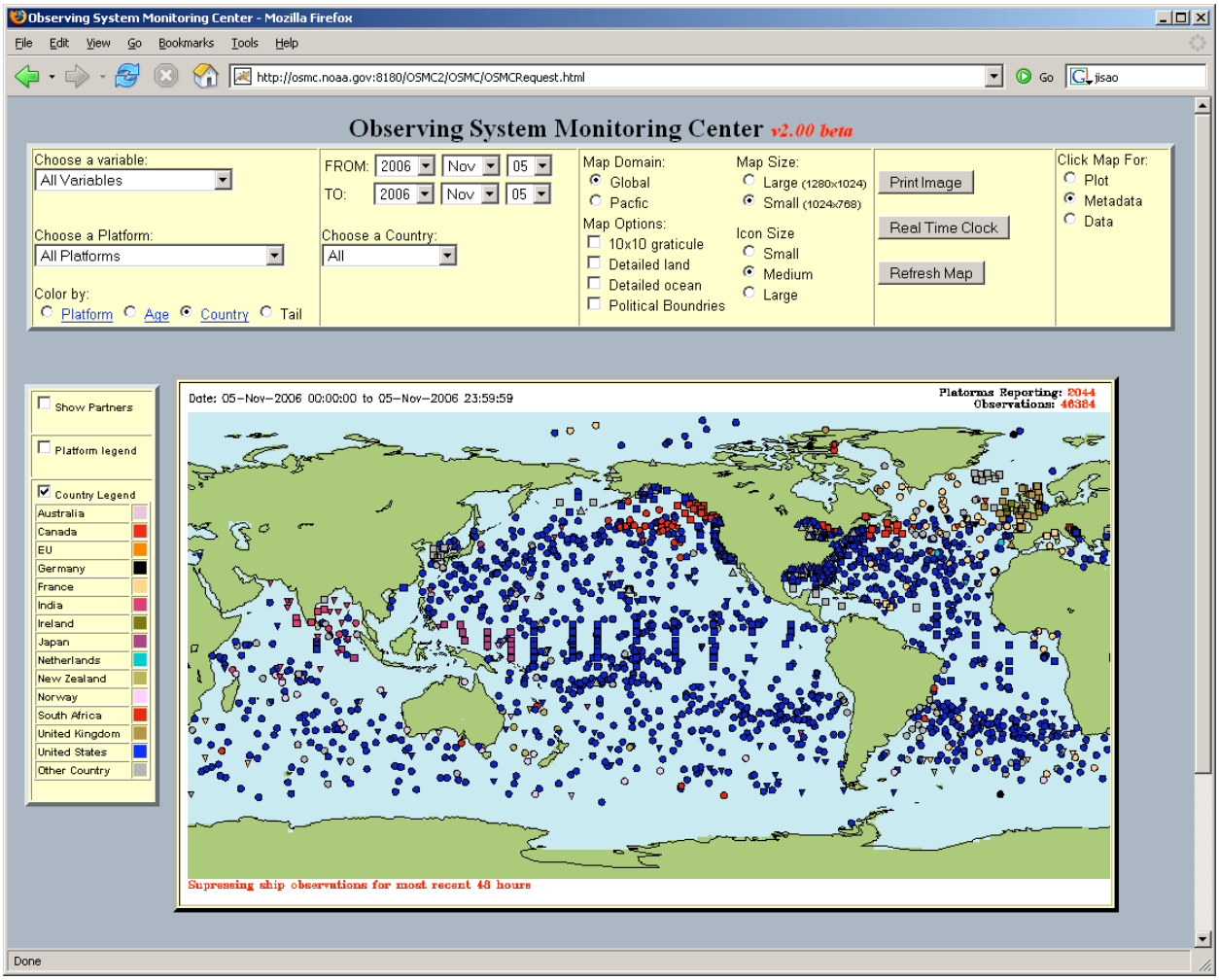


Figure 1. Screen snapshot of OSMC interface

The OSMC system displays the current and historical status of the globally distributed surface meteorological and oceanographic *in situ* ocean observing system (Figures 1, 2). It provides dynamically generated maps to visualize the coverage of observations. The selection of observations may be constrained by observing platform, by parameter (temperature, sea level height, etc.), and by contributing nation. Maps may be requested for various time intervals – daily, weekly, monthly or arbitrary. With a click the user can "drill down" to see the metadata that describes a given observation.

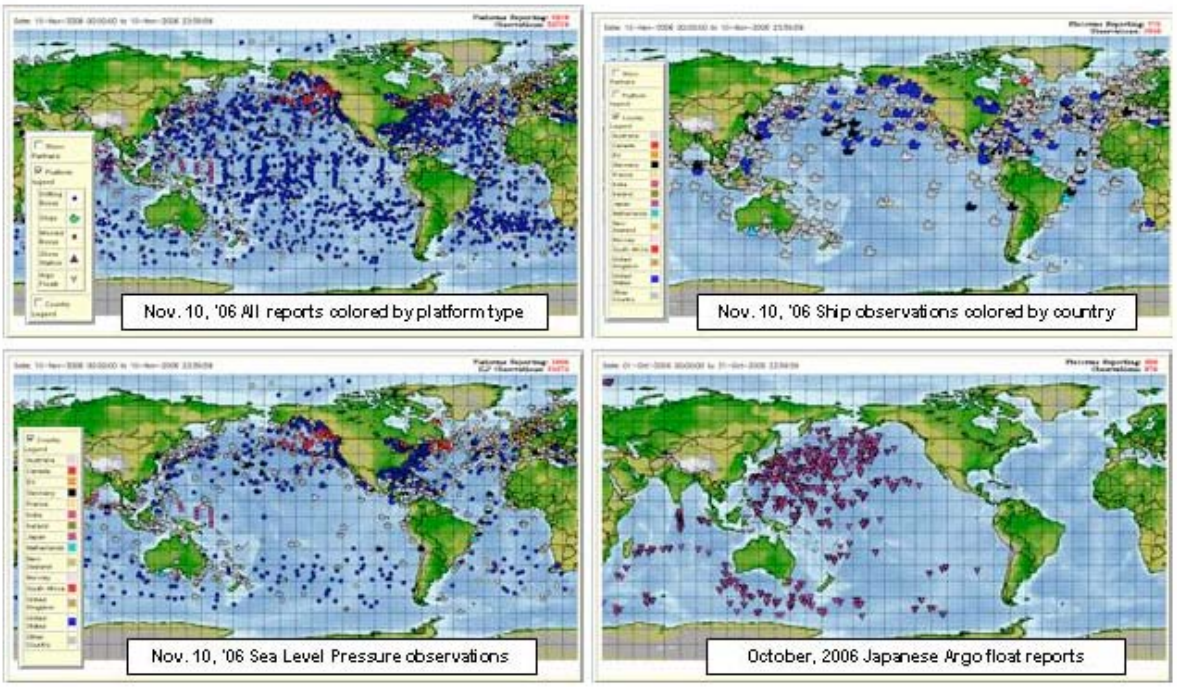


Figure 2. Sample OSMC maps

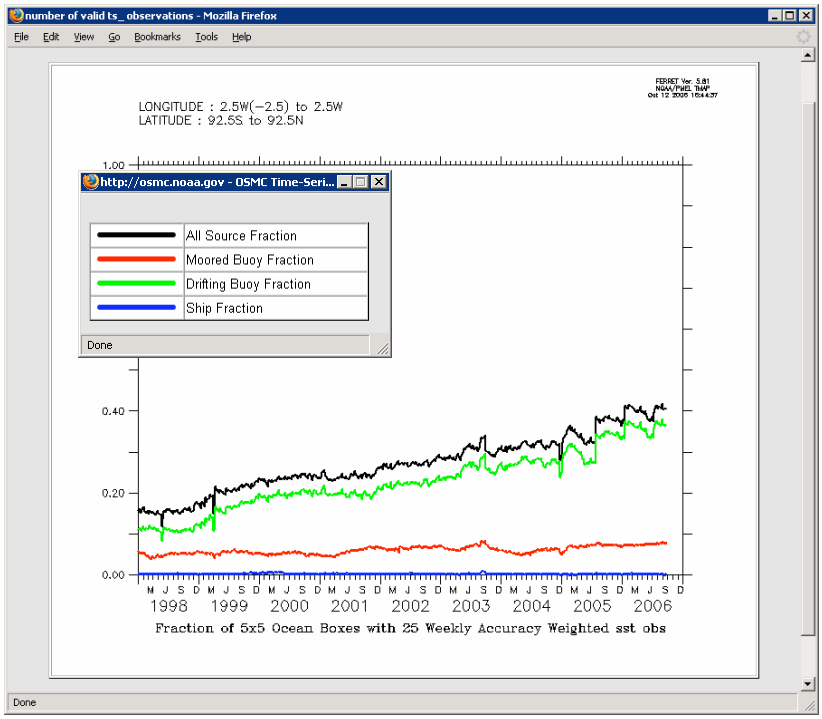
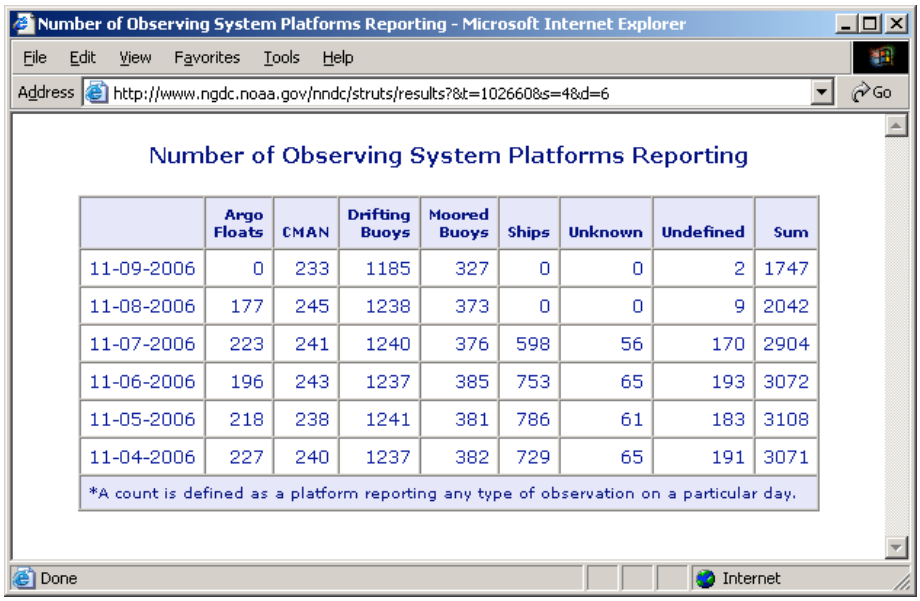


Figure 3. Progress in implementation of the ocean observing system

Other viewers in the OSMC also provide time series showing trends in observing system coverage (Figure 3). They provide tabulated summaries, showing the counts, continually updated, of observations by ocean basin and platform type, and the contributing nation (Figure 4). And they provide visualizations of the observations on a globe (with Google Earth®) (Figure 5) and via ESRI ArcIMS® tools (Figure 6).



	Argo Floats	CMAN	Drifting Buoys	Moored Buoys	Ships	Unknown	Undefined	Sum
11-09-2006	0	233	1185	327	0	0	2	1747
11-08-2006	177	245	1238	373	0	0	9	2042
11-07-2006	223	241	1240	376	598	56	170	2904
11-06-2006	196	243	1237	385	753	65	193	3072
11-05-2006	218	238	1241	381	786	61	183	3108
11-04-2006	227	240	1237	382	729	65	191	3071

*A count is defined as a platform reporting any type of observation on a particular day.

Figure 4. One of many OSMC table-style summaries

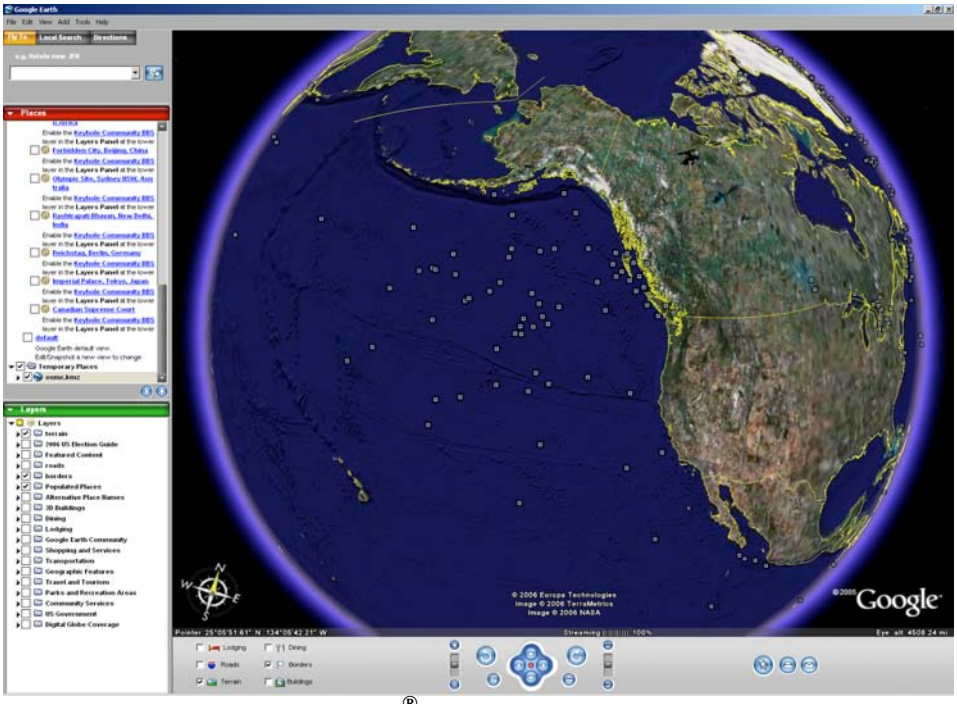


Figure 5. Google Earth® viewer showing ocean observations

As the system is further developed analysis capabilities will be added through collaborations with the Climate Observing System Council (COSC), that will assess the adequacy of the observations to compute critical ocean state fields, such as sea surface temperature. A limited capability to project drifter locations into the future will be added, so that we may anticipate gaps in the observing system and better deploy resources.

The OSMC system is available on-line at http://www.osmc.noaa.gov (note that at the time of this writing a new home page is under construction). It is provided as a resource to other NOAA centers, national research partners, and international partners.

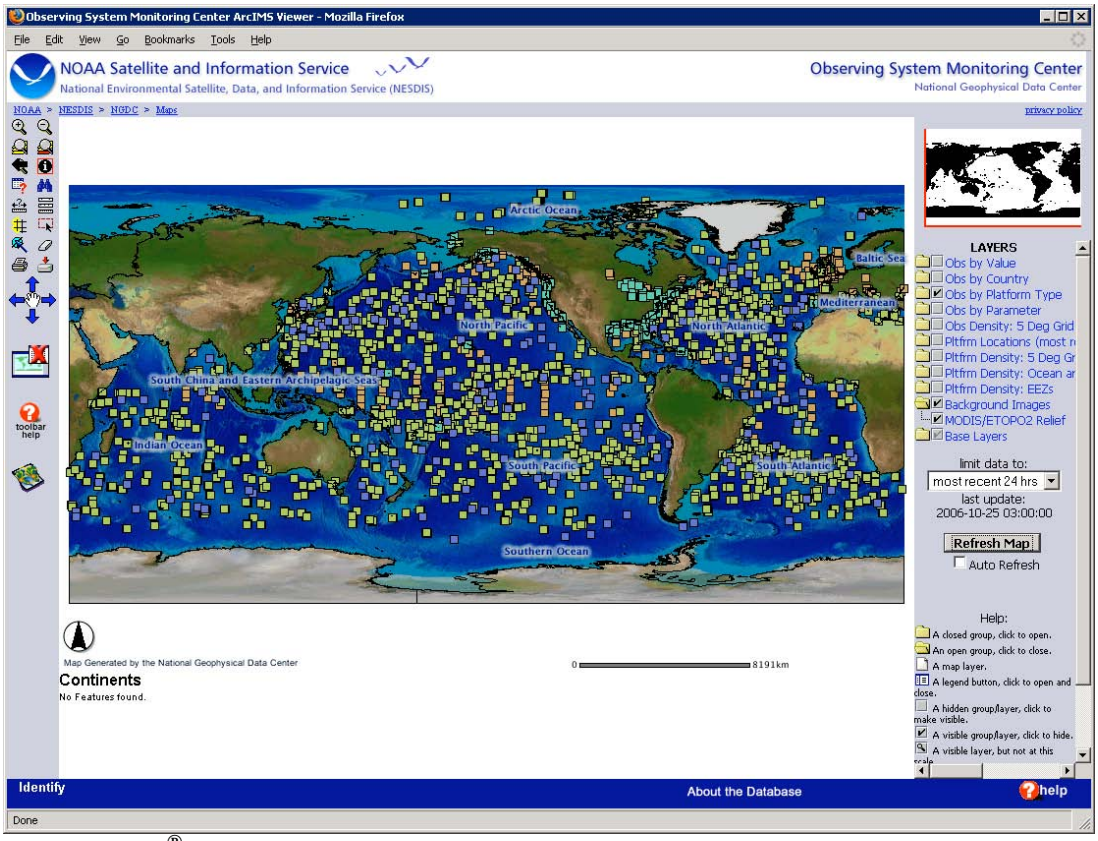


Figure 6 ArcIMS® viewer showing observations taken during the last 5 days, colored by platform type

The OSMC project is a joint development effort between the Pacific Marine Environmental Laboratory (PMEL) in Seattle, Washington; the National Data Buoy Center (NDBC) at Stennis Space Center in Mississippi; and the National Geophysical Data Center (NGDC) in Boulder, Colorado. The project is aligned to take advantage of the strengths of each organization. PMEL (an ocean/climate research laboratory) is responsible for the user interface/graphics/analysis tools; NDBC (an operational organization) is responsible for the data; and NGDC (a data center) provides consulting and development services on the use of data bases and GIS interfaces.

The OSMC is being designed in close cooperation with the JCOMM in situ Observing Platform Support Centre (JCOMMOPS). The development of the OSMC represents an important step towards the fulfillment of commitments to the Ten Climate Monitoring Principles.

FY2006 Progress

The following milestones track the progress made on OSMC during fiscal year 2006.

All (PMEL, NDBC, NGDC)

- Presented an OSMC overview at the NOAA Climate Observation Program 4th Annual System Review in Silver Spring (May 10-12, 2006). Solicited feedback from the Climate Observing System Council (COSC).

- Held OSMC technical meeting June 13,14 2006 at PMEL, Seattle

PMEL Accomplishments

- Developed v2.00 OSMC system for individual observations offering
  - Selection of observations based upon parameter, platform type, country, and date
  - Map outputs with tailored platform type icons and color control by country, time since observation, and platform type. Option to show drifter tails.
  - Improved readability and content to drill down functionality (metadata reports)
  - Configurable map size to address different desktop and laptop screen resolutions
  - Uses local connection to OSMC Oracle database maintained at NDBC
  - Higher performance and easier maintenance by using the new LAS version 7
  - Added a status bar to inform user that product was being generated.
  - Added user-selectable legend information on left side of map overview.
  - Added icons representing contributing organizations.
  - Improved reporting when region requested by user contains no observations.
  - Feedback to inform user that ship observations were being delayed by 48 hours.
  - Full list of platforms to the platform menu. Those not available are grayed out).

- New and continued analysis capabilities
  - Installed an independent v1.00 alpha system for OSMC analysis at NDBC utilizing summarized, gridded data for performance
  - Animations and time series graphics showing growth in the Observing System.
  - Static images showing monthly status of observing system

- Support for the Adopt-a-Drifter web site including numerous enhancements on request.
  - Adopt-a-Drifter provides educational opportunities through the Teacher at Sea program. It accesses the OSMC through a highly simplified user interface suitable for grade school students
  - Transferred responsibility for routine maintenance to Todd Pearce at OCO HQ.

- Performance
  - Major enhancements to performance, in part due to incorporation of improved SQL queries developed by partners (e.g. drifter tails query optimized by returning only a single location per day)

- **Not completed**:
  - New OSMC home page

        - Draft version remains to be made public. Transferred responsibility for this draft to Todd Pearce at OCO to ensure that it is consistent with the "corporate look and feel" of other OCO pages.
    - Tide gauges
        - Tide gauges were added to the UI as a new platform type. Further addition of tide gauges to the OSMC has been postponed pending a redesign of the OSMC database schema (currently underway).
    - "Last reported" maps
        - A "most recent report" option has been prototypes, but release has been delayed to correct database inconsistencies.

NDBC Accomplishments

- Continued to update the OSMC Oracle database and NetCDF files with data from the following sources:
    - GODAE T-File
    - WMO Allocation table (Country info)
    - WMO Pub 47 data (meta-data)
    - JCOMOPS floats (meta-data)
    - NDBC Website (meta-data)

- New data sources added
    - Tsunami DART observations. Actual data is available via a URL link.
    - NOS Tide Gauge stations. Actual data is available via a URL link.
    - The main Ocean Reference sites of interest to the Climate Office. Additional sites will be added during FY07.

- Proposed a replacement data source for the GODAE T-Files using the NDBC GTS feed via the NWSTG.

- Database technical enhancements
    - Implemented a 48 delay for ship data to address security concerns.
    - Working to finalize the database scheme redesign incorporating improvements recommended by NGDC.
    - Upgraded the OSMC Oracle database from Standard Edition to Enterprise Edition. Also configured database tuning.
    - Performed several reconciliations between the OSMC float information and the JCOMMOPS web graphic. Currently the two systems are reporting similar numbers for the GTS floats.
    - Performed OSMC server upgrades and security patches as required.

NGDC Accomplishments

- Research strategies to improve database performance
    - Continued to enhance prototype parameter/value database design.

- Demonstrated ability to use spatial object in prototype database design through spatial queries against U.S. Exclusive Economic Zones and World Ocean / Sea Names, and five-degree cells.
- Results of these queries are displayed on the map viewers and as chained text views that support drill-down through nested regions.

- Work with partners to implement improvements as determined through research
  - Participated with NDBC in the database design white paper.
  - Implemented scripts for transforming the content of the original OSMC database tables into the prototype design. This includes extracting data from XML fields and migrating that data into the mainstream design.
  - Tested these scripts on an on-going basis by running them daily at NGDC. The resulting database has been used for the ArcIMS and Google Earth viewers.
  - Will provide these scripts to our partners at NDBC to help them in the operational database design evolution.

- Explore further application of COTS internet mapping tools (ESRI ArcIMS)
  - Added observation density layers for EEZs, Oceans and Seas, and five-degree grid cells to map, with access to table views of data to the ArcIMS viewers.
  - Implemented many of the data access features of the ArcIMS viewer using the Google Earth Viewer. The Google Earth implementation includes links to report on observations for selected platform.

- Access to recent OSMC data using Open Geospatial Consortium web services
  - Demonstrated access to OSMC map layers using OGC WMS requests.

- Create text/table output capabilities supporting a variety of queries and reports
  - Have implemented tabular summary views of the OSMC database including: Number of observations / type / day; Number of observations / country / type / day; Number of observations / EEZ Region / type / day; Platforms / EEZ Region / day; Number of observations / 5 degree tile; Observations / Platform; Number of observations / Ocean or Sea / type / day; Platforms / Ocean or Sea / day; Platform / type / day

- Database integrity checks
  - NGDC did an extensive comparison of platforms in the OSMC database and the NOSA database, including NOSA DART, NWLON, BOY, and MAN stations, as well as presence on the Tides and Currents web page. The results of these comparisons were provided to NDBC in a spreadsheet to help understand the overlaps and differences between various observing systems